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(54) Temporary coating compositions

(57) An alkali-soluble aqueous composition which is suitable for producing a temporary protective coating upon a surface which is prone to deterioration or damage, particularly a bare metal surface, comprises an aqueous medium and, dissolved or dispersed therein in salt form, an addition polymer having a weight average molecular weight of 3,000–15,000, a Tg of −15°C to +40°C, and contains both carboxyl groups and hydrophilic groups selected from acrylamide, C_{1-8} alkyl-substituted acrylamide, vinyl pyrrolidone, vinyl pyridine and poly(oxyethylene) groups. The salt is preferably formed with ammonia.

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SPECIFICATION

Coating compositions

This invention relates to aqueous coating compositions which are useful in providing a temporary, alkali-soluble coating for surfaces; more particularly for surfaces which are liable to deteriorate when in direct contact with the atmosphere or to be damaged, for example, by abrasion.

Alkali-soluble polymers, particularly carboxyl group-containing addition polymers, are known to be useful as temporary, protective coatings for surfaces. These are usually applied to a surface from an aqueous emulsion or from a non-aqueous solution, for example by spraying, and the resulting coating may be subsequently removed by treatment with aqueous alkali, for example an alkaline cleaning solution of conventional formulation. One specific use of such polymers is in providing temporary protection for a painted surface from the effect of abrasive particles and the like. A temporary coating, together with any adhering contamination, may be removed with aqueous alkali when it is no longer required and may, if necessary, then be replaced by a fresh coating suitable to its future use.

Many surfaces are liable to deteriorate when they are exposed directly to the atmosphere, for example due to humid conditions. These surfaces may be, for example, of finished articles or of articles which are at an intermediate or semi-finished stage of manufacture and to which it is not appropriate to apply a permanent coating in order to prevent deterioration. Typical surfaces which are liable to deteriorate are those comprising a ferrous metal such as steel and galvanised steel, copper and aluminium whether painted or unpainted. Deterioration may be due, for example, to the oxidation of a metal surface, for example the rusting of ferrous surfaces or the formation of an oxide layer on an aluminium surface, or to the atmospheric weathering of painted surfaces. Painted or polished surfaces may also be damaged by abrasion, for example at an intermediate stage of manufacture.

Typical materials which have been applied to these surfaces in order to prevent deterioration or damage due to abrasion include oils, greases, waxes and solvent-based lacqueres. In examining the usefulness of alkali-soluble polymers, of the general type already mentioned above, as possible candidates for replacing, and improving the performance of the oils, waxes and the like, we have found that a selected group of addition polymers can be used to provide temporary coating compositions which have a particularly good balance of properties. These properties include, for example, absence of flash rusting when drying on ferrous surfaces, ease of removal with aqueous alkaline compositions after a period of at least 4 weeks outdoor exposure to the atmosphere, low dirt retention during exterior exposure and ease of handling and stacking coated articles without damage to the coating. The polymers may also yield clear coatings which permit inspection of the coated surface but thse coatings may also be tinted for identification purposes.

According to this invention we provide an aqueous coating composition, suitable for application to a surface liable to deteriorate when it is directly exposed to the atmosphere or to be damaged by abrasion, which comprises:

(i) an aqueous liquid medium, and

(ii) an addition copolymer which is dissolved or dispersed in the aqueous liquid medium in the form of a salt, the addition copolymer having the following characteristics:

(a) it has a weight average molecular weight in the range 3,000–15,000;

(b) it has a glass transition temperature (Tg) as herein defined in the range $-15°C$ to $+40°C$;

(c) it comprises 2–20% by weight of residues derived from one or more hydrophilic comonomers selected from: acrylamide and derivatives thereof in which the amido nitrogen atom is substituted by a C_1–C_8 alkyl group; vinyl-pyrollidone; vinylpyridine; and monomers which comprise a poly(oxyethylene) chain of average molecular weight at least 100; and

(d) it carries carboxyl groups equivalent to an acid value in the range 25–150 mg KOH/g.

Preferably the copolymer is one which has been prepared by solution copolymerisation of the comonomers in an organic liquid and has subsequently been treated with a base and diluted with water.

The polymer may be present in the aqueous medium in the form of a true solution, a colloidal solution or a dispersion of particles, but in any event at least some of the carboxyl groups in the addition polymer are neutralised by a base, for example ammonia and/or one or more amines. In most cases, apart from a haze, the addition polymer will appear to be in solution.

According to another aspect of this invention we provide a method of giving temporary protection to a surface liable to deteriorate on direct exposure to the atmosphere or to be damaged by abrasion which comprises applying to the surface a coating composition as above defined and allowing the volatile material present to volatilise.

According to a further aspect of this invention we provide an article having a surface liable to

deteriorate on direct exposure to the atmosphere, or to be damaged by abrasion, the surface having a temporary alkali-soluble coating derived from a coating composition as defined above.

The aqueous medium (i) of the coating composition preferably contains a water-miscible co-solvent for the addition polymer, for example an alkanol or an alkyl ether of ethylene glycol or propylene glycol. Suitable water-miscible co-solvents include n-propanol, isopropanol, n-, sec-, and isobutanol, ethylene glycol monobutyl ether, propylene glycol monomethyl ether, and the monomethyl ether of dipropylene glycol.

In selecting a suitable aqueous liquid medium it is necessary to consider such facts as the rate of volatilisation of the liquid medium which is desired after application of the composition to a surface; the method of application to the surface, for example whether by spraying or brushing; the solubility and/or stability of the addition polymer in the medium; the flammability of the medium, and any requirement which is dictated by the nature of the surface, for example the need to dissolve any oil which is on the surface. There may be present a small proportion of a non-water-miscible solvent.

It is often convenient to include as at least part of the aqueous medium of the coating composition the organic solvent in which the addition polymer has been prepared. In certain cases, however, it may be preferred to remove some or the whole of this solvent and to dissolve or disperse the addition polymer in a different continuous medium, for example one which is more volatile or one which is of different polarity.

The addition polymer (ii) is prepared from polymerisable, ethylenically unsaturated monomers by conventional procedures using free radical initiators such as azodiisobutyronitrile, and is preferably prepared in solution in organic solvents, for example isopropanol, sec-butanol, ethylene glycol monobutylether or propylene glycol monomethyl ether, which are miscible with both water and with any other desired solvents. When a particular monomer is not soluble in the organic solvent to be used as the polymerisation medium, it may be dissolved in another solvent which is miscible with the organic solvent. For example, (meth)acrylamide may be dissolved in the minimum proportion of water before addition to the site of polymerisation. The molecular weight of the polymer can be controlled by conventional methods, for example using chain terminating agents such as thioglycollic acid.

Preferably the molecular weight is in the range 5000–14,000.

Preferably the carboxyl groups present in the addition polymer are introduced by the use of acrylic and/or methacrylic acid as a comonomer although other carboxyl group-containing or -generating monomers may be used, for example maleic anhydride. Preferably the acid value is not greater than 100 mg KOH/g.

It is an advantage of the low molecular weight of the copolymer that treatment with a base does not cause undesired thickening of the composition.

The extent of neutralisation of the copolymer may vary depending upon the specific use intended. When it is desired that a touch-dry or water-resistant coating shall be quickly obtained it is necessary to use a suitably volatile base.

The hydrophilic comonomer residue of the copolymer as defined may be obtained by post-modification of a preformed addition polymer, for example of a polymer containing a precursor of the monomer residue which can be converted to yield the defined residue. However the hydrophilic monomer residues are preferably introduced into the polymer by conventional polymerisation procedures. The monomer residues of, for example, acrylamide, methacrylamide, vinyl pyrollidone and vinylpyridine may be introduced directly by use of these compounds as comonomers. a poly(oxyethylene) chain may be introduced by using a comonomer which includes such a chain in the molecule, for example methoxypoly(ethyleneglycol)(meth)acrylate, or by post-reacting a group on the preformed polymer which is reactive with, for example, a polyethylene glycol. Preferably the addition polymer comprises at least 3% by weight of the hydrophilic comonomer residue.

Particularly preferred hydrophilic comonomer residues in the addition polymer are comonomer residues of acrylamide and/or methacrylamide, since polymers according to the invention which contain these residues provide the best balance of properties as temporary coatings on surfaces liable to deterioration, particularly on ferrous surfaces which are liable to rust.

Comonomers which are free from carboxyl groups and which do not comprise the defined hydrophilic residues may additionally be used in preparing the addition polymer. Such comonomers include the alkyl esters of (meth)acrylic acid, for example methyl methacrylate, ethyl acrylate or butyl acrylate, and aromatic monomers such as styrene or vinyltoluene.

Preferably, in the preparation of the addition polymer there is used 5–20% by weight of a carboxyl group-containing comonomer, 2–20% of a comonomer which comprises the defined hydrophilic monomer residue, or a precursor of the residue, and 60–93% of other comonomer(s).

Preferably there is present 3–15% by weight of (meth)acrylamide residues.

The glass transition temperature (Tg) of a coating material is a parameter which frequently presents difficulties in estimation, with different experimental techniques leading to different

results. Although it is a function primarily of the composition of the polymer in respect of the comonomers present and their proportions, other factors such as molecular weight may play a part. For the present purpose, our Tg values are those derived by the use of the expression presented in "Polymer Handbook" by J. Brandup and E.M. Immergut (Interscience, London) namely

$$\frac{100}{Tg\ (copolymer)} = \frac{\%\ monomer\ A}{Tg\ (homopolymer\ A)} + \frac{\%\ monomer\ B}{Tg\ (homopolymer\ B} + etc.$$

For the Tg values of the individual homopolymers we have relied on the values given in this source and the derived calculated values constitute the definition of Tg according to this specification.

The coating compositions of this invention are preferably of solids content in the range 5 to 25% by weight. They may also contain certain additives which will further improve their performance and range of application, for example anti-corrosion additives, flow aids and dyes or pigments.

The methods of application are conventional; for example by spraying, brushing or dipping. The thickness of the coatings obtained is preferably in the range 10–20μ but thinner coatings may be employed, especially on non-corrodible substrates.

It is an important advantage of the present selected addition polymers for use in coating compositions that the coating which they provide is readily removed from a surface, particularly a bare metal surface, by treatment with aqueous alkali, for example a 1–2% solution of caustic alkali in water. It is a particular advantage that the coating can be removed by an alkaline solution such as is conventionally used to clean bare metal articles before they are subjected to a metal pretreatment process such as phosphating. Such articles will often carry a corrosion-resistant oil or wax layer which has to be removed by an alkali treatment. Therefore this invention also provides an improved process of metal pretreatment wherein a metal article to be treated, for example by phosphating, carries a coating of the type herein described and is subjected to an aqueous alkali treatment prior to the reaction of the metal with a pretreatment reagent.

The invention is illustrated by the following Examples in which parts and percentages are by weight.

EXAMPLE 1

This Example describes the preparation in organic solvent solution of a copolymer, comprising methacrylamide as a comonomer, which is suitable for use according to the invention; the preparation therefrom of an aqueous solution; and the use of the solution according to the invention.

(a) Azodiisobutyronitrile (37.5 g) was dissolved in a mixture of the monomers methyl methacrylate (262.5 g), butyl acrylate (337.5 g), methacrylic acid (75.0 g) and methacrylamide (75.0 g) and of isopropanol (350 g), and the mixture was added over a period of 3 hours to isopropanol (150 g) which was being heated under nitrogen and under reflux so that the reaction mixture was maintained at 80°C. After the addition was complete the product was maintained at 80°C for a further 1 hour, when azodiisobutyronitrile (7.5 g) was added and the product further maintained at 80°C for 1 hour.

The final product, a copolymer of weight composition methyl methacrylate/butyl acrylate/methacrylic acid/methyacrylamide = 35/45/10/10 had a solids content of 60.5% by weight (determined by heating for 1 hour at 120°C) and an acid value of 63.8 mg KOH/g. The calculated Tg of the polymer was 22°C and the molecular weight (weight average determined by GPC) was 9,324.

(b) 33 parts of the solution of copolymer in isopropanol as prepared above were treated with 2 parts of ammonia (specific gravity 0.880) which amount was equivalent to complete neutralisation of the carboxyl groups present. The mixture was stirred until clear and 65 parts of demineralised water were then added to give a slightly hazy solution of copolymer at 20% solids content having a pH of 9.3.

(c) The solution of copolymer prepared in (b) was spray applied to a degreased bare steel panel measuring 15 cm × 10 cm by a double-pass using a conventional air-fed spray gun having an inlet pressure of 70 psi. A touch-dry coating film was formed within 10 minutes at 21°C and there was no sign of "flash-rusting". The final film thickness was 17 microns.

After overnight storage the coated panel was exposed to the weather on a south-facing flat roof. After 4 weeks exposure in Southern England summer conditions the panel showed very little corrosion and the coating film showed negligible dirt pick-up. The coating film was easily removed from the panel after contact with an alkaline remover at room temperature for 2 minutes. The remover composition was sodium hydroxide (1 part) n-butanol (2 parts), hydroxy-

propylmethyl cellulose (1 part), surfactant (0.1 part) and de-ionised water (60 parts).

(d) The solution of copolymer prepared in (b) was also spray applied by the procedure described in (c) but to a metal panel which had been previously coated with a glossy paint topcoat. The panel was then exposed, at a commercial test site in Florida, USA, at 45° to the horizontal facing south for a period of 3 months. The copolymer coating then showed very little dirt pick-up and had a good gloss. It was easily removed from the paint topcoat after 5 minutes contact at room temperature with the alkaline remover described in (c). The paint topcoat was still very glossy and showed no evidence of dulling or deterioration.

EXAMPLE 2

This Example describes the preparation in an organic solvent (different from that used in Example 1) of a copolymer comprising acrylamide as a comonomer and suitable for use according to the invention; the preparation therefrom of an aqueous solution and the use of the solution according to the invention.

(a) Azodiisobutyronitrile (90 g) was dissolved in a mixture of monomers comprising methyl methacrylate (414 g), butyl acrylate (1026 g) methacrylic acid (180 g) and acrylamide (180 g), and the mixture was gradually added over a period of 3 hours to propylene glycol monomethylether (commericaly available as "Dowanol PM") (1092 g) which was being heated under reflux (120°C). The reaction mixture was maintained at 120°C, and further quantities of azodiisobutyronitrile (18 g) and of propylene glycol monomethylether (54 g) were added to the mixture 1 hour after the monomer addition was complete. The resulting product was then held at reflux temperature for a further 1 hour.

The final product, a copolymer of weight composition methyl methacrylate/butyl acrylate/methacrylic acid/methacrylamide = 23/57/10/10, had a solids content of 60%, and an acid value of 65 mg KOH/g. The calculated Tg of the polymer was −0.5°C and the molecular weight (weight average, determined by GPC) was about 10,000.

(b) 36.5 parts of the solution of copolymer in propylene glycol monomethylether as prepared above was treated with 2 parts of ammonia (specific gravity 0.880) which amount was equivalent to complete neutralisation of the carboxyl groups present. The mixture was stirred until clear and 61.7 parts of demineralised water were then added to give a slightly hazy solution of 22% solids content having a pH of 9.5.

(c) The aqueous solution prepared in (b) above was spray applied to a degreased bare steel panel measuring 15 cm × 10 cm by the procedure of Example 1(c). The coating film was touch-dry after 15 minutes at 20°C and there was no flash-rusting. The final dry film was 20 microns in thickness.

After overnight interior storage, the coated panel was exposed to the weather, facing south, for 4 weeks under Southern England winter conditions. There was very little rust spotting on the panel at the end of this period and the coating was easily removed with an alkaline remover composition similar to that of Example 1(c).

EXAMPLE 3

This Example describes the preparation and use according to the invention of a copolymer similar to that of Example 1 except that there was present only 5%, instead of 10%, of methacrylamide as a comonomer.

(a) The copolymer produced in this Example by the procedure of Example 1 was of weight composition methyl methacrylate/butyl acrylate/methacrylic acid/methacrylamide = 25/60/10/5 and was a 58.2% solids content solution in isopropanol. The calculated Tg of the copolymer was −4.6°C and the molecular weight (weight average, measured by GPC) was 10,917.

(b) 36.1 parts of the polymer solution produced in (a) were treated with 2 parts of ammonia (specific gravity 0.880). The mixture was stirred until clear and 61.9 parts of demineralised water were then added with stirring to give a slightly hazy solution of 21% solids having a pH of 9.05.

(c) The aqueous solution prepared in (b) was applied to a bare steel panel by spraying as described in Example 1(c). The coating film produced was touch-dry after 10 minutes at 20°C and there was no flash-rusting.

After overnight interior storage the panel was exposed to the weather facing south, for 3 months of winter conditions in Southern England. The coating had very little rust spotting after this time and was easily removed using the alkaline remover described in Example 1(c).

EXAMPLE 4

This Example describes the preparation and use of a copolymer prepared by a process similar to that used in Example 2 except that the comonomer acrylamide was replaced by 5% of a comonomer incorporating a methoxypoly(oxyethylene) moiety of molecular weight 350 and the acid content was halved.

(a) The copolymer produced in this Example by the procedure of Example 2 was of weight composition methylmethacrylate/butyl acrylate/methacrylic acid/methoxypolyethylene glycol methacrylate = 53/37/5/5, and was a 67.8% solids solution in propylene glycol monomethylether. The acid value of the copolymer was 37.1 mg KOH/g; the calculated Tg of the polymer was 16°C and the weight average molecular weight of the copolymer was 8,172.

(b) 34.3 parts of the polymer solution from (a) above were treated with 1 part of ammonia (0.880) and 64.7 parts of demineralised water to give a hazy solution at 20.7% solids and of pH 8.8.

(c) The aqueous solution prepared in (b) was spray applied to a bare steel panel as described in Example 1, to give a dry coating film thickness of 12 microns. After 2 months exposure to summer weather conditions there was very little corrosion of the steel and the film was easily removed after 2 minutes contact with the alkaline remover described in Example 1.

(d) The aqueous solvent solution prepared in (b) was spray applied to and formed a coating film on a panel to which had been previously applied a thermoplastic acrylic paint topcoat. After interior overnight storage the coated panel was exposed for 8 months to Southern England weather conditions during the summer–autumn–winter period. The coating film was dulled but remained intact with little dirt pick-up. It was easily removed using the alkaline remover described in Example 1. The paint topcoat showed excellent gloss retention with no sign of defects in the surface.

COMPARATIVE EXAMPLE

This Example shows that, in the absence of a hydrophilic comonomer as hereinefore defined, the addition copolymer (ii) does not confer on the coating composition the advantageous properties demonstrated in the preceding Examples.

(a) A copolymer was prepared as a solution in isopropanol by the procedure of Example 1, with the weight composition methyl methacrylate/butyl acrylate/methacryic acid = 46/44/10. The solids content was 61.78% and the copolymer had an acid value of 65 mg KOH/g, a calculated Tg of 17.1°C and a weight-average molecular weight of 14,900.

(b) 33.2 parts of the polymer solution from (a) were treated with 8.7 parts of a 5% aqueous ammonia solution and 58.1 parts of demineralised water. The slightly hazy solution was of 20.5% solids content and had a pH of 9.3.

(c) The aqueous solution from (b) was spray-applied to a degreased bare steel panel to give a coating of 15 microns thickness.

After overnight interior storage, the panel was exposed to Southern England late summer weather conditions for 1 month. After this period of time there was unacceptable scattered rust spotting over the panel. Using the alkaline remover of Example 1, the removal of the coating film from the panel was incomplete after 2 minutes contact time, there being a residue of polymer coating.

COMPARATIVE EXAMPLE

This Example shows that, in the absence of a hydrophilic comonomer as hereinbefore defined, the addition copolymer (ii) does not confer on the coating composition the advantageous properties demonstrated in the preceding Examples.

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(b) 33.2 parts of the polymer solution from (a) were treated with 8.7 parts of a 5% aqueous ammonia solution and 58.1 parts of demineralised water. The slightly hazy solution was of 20.5% solids content and had a pH of 9.3.

(c) The aqueous solution from (b) was spray-applied to a degreased bare steel panel to give a coating of 15 microns thickness.

After overnight interior storage, the panel was exposed to Southern England late summer weather conditions for 1 month. After this period of time there was unacceptable scattered rust spotting over the panel. Using the alkaline remover of Example 1, the removal of the coating film from the panel was incomplete after 2 minutes contact time, there being a residue of polymer coating.

EXAMPLE 5

This Example describes the preparation and use of a copolymer prepared by a process similar to that used in Example 3, except that the hydrophilic comonomer methacrylamide was replaced with vinyl pyrollidone and the ratio of methyl methacrylate to butyl acrylate was adjusted to give a calculated Tg of −5°C.

(a) The copolymer produced in this Example by the procedure of Example 3 was of weight composition methyl methacrylate/butyl acrylate/methacrylic acid/vinyl pyrolli-

done = 27.8/57.2/10/5 and was a 55.2% solids content solution in isopropanol. The calculated Tg of the copolymer was − 5°C.

(b) 36.2 parts of the polymer solution produced in (a) were treated with 1.8 parts of ammonia (specific gravity 0.88). The mixture was stirred until clear and 62 parts of demineralised water were then added with stirring to give a slightly hazy solution of 20% solids having a pH of 9.2.

(c) The aqueous solution prepared in (b) was applied to a bare steel panel by spraying as described in Example 1(c). The coating film produced was touch-dry after 10 minutes at 20°C and there was no flash-rusting. the film thickness was between 11.6 and 13 microns (as determined by Permascope).

After overnight interior storage the panel was exposed to the weather, facing south, for 1 month of autumn conditions in Southern England.

The coating had very little rust-spotting after this time and was easily removed using the alkaline remover described in Example 1(c).

EXAMPLE 6

This Example describes the preparation and use of a copolymer prepared by a process similar to that used in Example 3, except that the hydrophilic comonomer methacrylamide was replaced with 4-vinylpyridine and the ratio of methyl methacrylate to butyl acrylate was adjusted to give a calculated Tg of − 5°C.

(a) The copolymer produced in this Example by the procedure of Example 3 was of weight composition methyl methacrylate/butyl acrylate/methacrylic acid/4-vinylpyridine = 26.2/57.9/10/5 and was a 57.9% solids content solution in isopropanol. The calculated Tg of the copolymer was − 5°C.

(b) 34.5 parts of the polymer solution produced in (a) were treated with 1.8 parts of ammonia (specific gravity 0.88). The mixture was stirred until clear and 63.7 parts of demineralised water were then added with stirring to give a slightly hazy solution of 20% solids having a pH of 9.5.

(c) The aqueous solution prepared in (b) was applied to a bare steel panel by spraying as described in Example 1(c). The coating film produced was touch-dry after 10 minutes at 20°C and there was no flash-rusting. The film thickness was between 14.5 and 15.5 microns (Permascope).

After overnight interior storage the panel was exposed to the weather, facing south, for 3 months of winter conditions in Southern England.

The coating had very little rust-spotting after this time and was easily removed using the alkaline remover described in Example 1(c) after a 1-minute contact time.

CLAIMS

1. An aqueous coating composition, suitable for application to a surface liable to deteriorate when it is directly exposed to the atmosphere or to be damaged by abrasion, which comprises:

(i) an aqueous liquid medium, and

(ii) an addition copolymer which is dissolved or dispersed in the aqueous liquid medium in the form of a salt, the addition copolymer having the following characteristics:

(a) it has a weight average molecular weight in the range 3,000 to 15,000;

(b) it has a glass transition temperature (Tg) as herein defined in the range − 15°C to + 40°C;

(c) it comprises 2–20% by weight of residues derived from one or more hydrophilic comonomers selected from: acrylamide and derivatives thereof in which the amido nitrogen atom is substituted by a C_1–C_8 alkyl group; vinyl-pyrollidone; vinylpyridine; and monomers which comprise a poly(oxyethylene) chain of average molecular weight at least 100; and

(d) it carries carboxyl groups equivalent to an acid value in the range 25–150 mg KOH/g.

2. A composition as claimed in claim 1, wherein the addition copolymer has been prepared by solution copolymerisation of the comonomers in an organic liquid and has subsequently been treated with a base and diluted with water.

3. A composition as claimed in claim 1 or claim 2, wherein the aqueous medium (i) contains a water-miscible co-solvent for the addition copolymer.

4. A composition as claimed in claim 3, wherein the water-miscible co-solvent is an alkanol or an alkyl ether of ethylene glycol or propylene glycol.

5. A composition as claimed in any one of claims 1 to 4, wherein the copolymer has a molecular weight in the range 5000–14000.

6. A composition as claimed in any one of claims 1 to 5, wherein the carboxyl groups present in the addition copolymer are introduced by the use of acrylic acid and/or methacrylic acid as comonomer.

7. A composition as claimed in any one of claims 1 to 6, wherein the acid value of the copolymer is not greater than 100 mg KOH/g.

8. A composition as claimed in any one of claims 1 to 7, wherein the hydrophilic monomer residues are introduced into the addition copolymer by use of acrylamide and/or methacrylam-

ide as comonomer.

9. A composition as claimed in any one of claims 1 to 8, wherein there are used in the preparation of the copolymer (a) 5–20% by weight of a carboxyl group-containing comonomer, 2–20% of a comonomer which comprises the defined hydrophilic monomer residue, or a precursor of the residue, and 60–93% of other co-monomer(s).

10. A composition as claimed in claim 8, wherein there is present in the copolymer from 3% to 15% by weight of (meth)acrylamide residues.

11. A composition as claimed in any one of claims 1 to 10, having a solids content of 5% to 25% by weight.

12. A composition according to claim 1 substantially as described in any one of the foregoing Examples.

13. A method of giving temporary protection to a surface liable to deteriorate on direct exposure to the atmosphere or to be damaged by abrasion which comprises applying to the surface a coating composition as claimed in any one of claims 1 to 12, and allowing the volatile material present to volatilise.

14. A method according to claim 13 substantially as described in any one of the foregoing Examples.

15. An article having a surface which is provided with a temporary alkali-soluble coating derived from a composition as claimed in any one of claims 1 to 12.

16. An article as claimed in claim 15, wherein the coating has a thickness in the range 10–20μm.

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